

National Aeronautics and
Space Administration



ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

 @NASAARSET

Smoke Monitoring From Space

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Satellite Remote Sensing of Air Quality

September 19-21, 2017

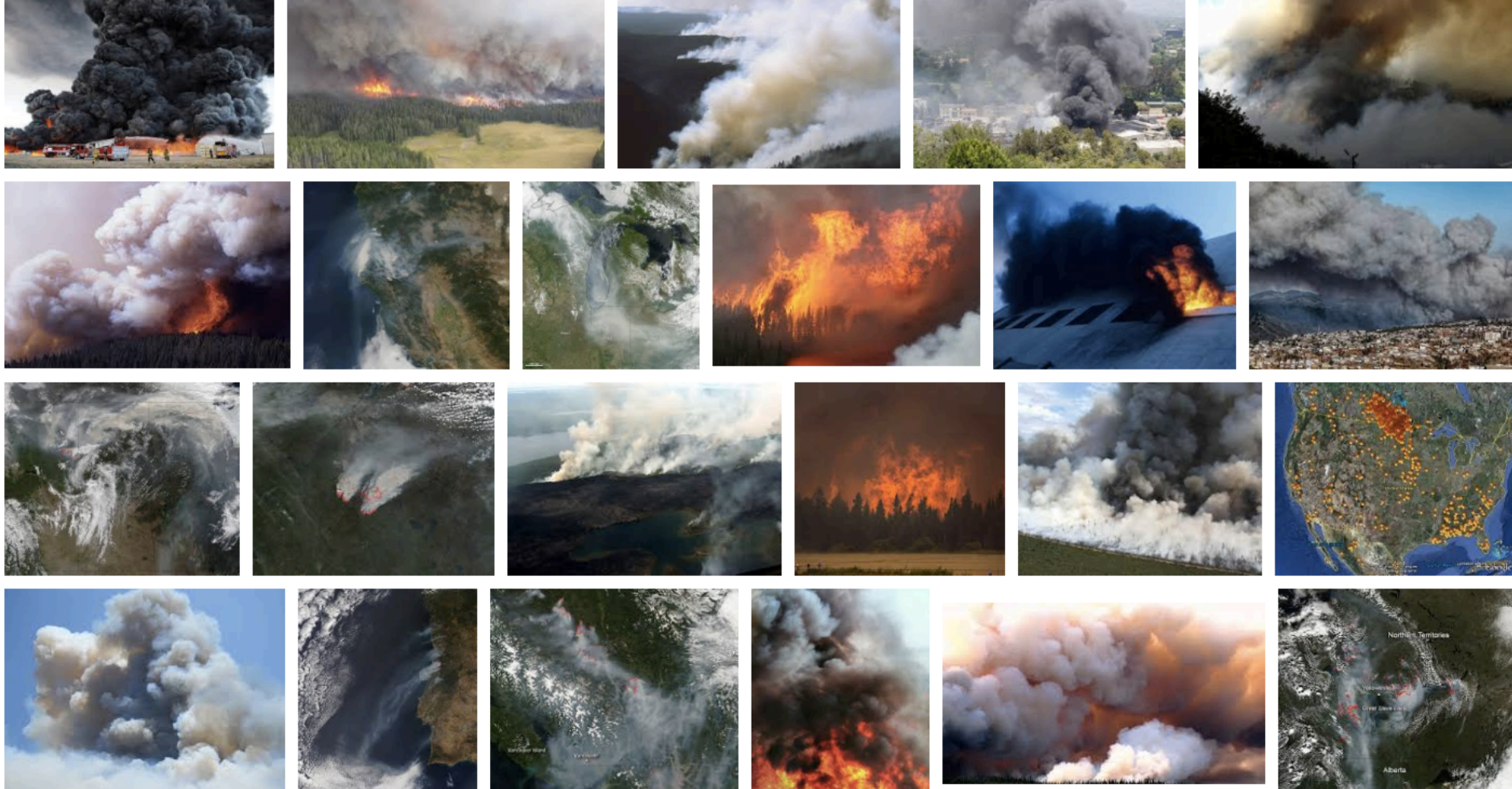
University of California, Riverside

Learning Objectives

By the end of this presentation, you will be able to:

- describe existing satellite capabilities for smoke monitoring
- describe available smoke products and their applications

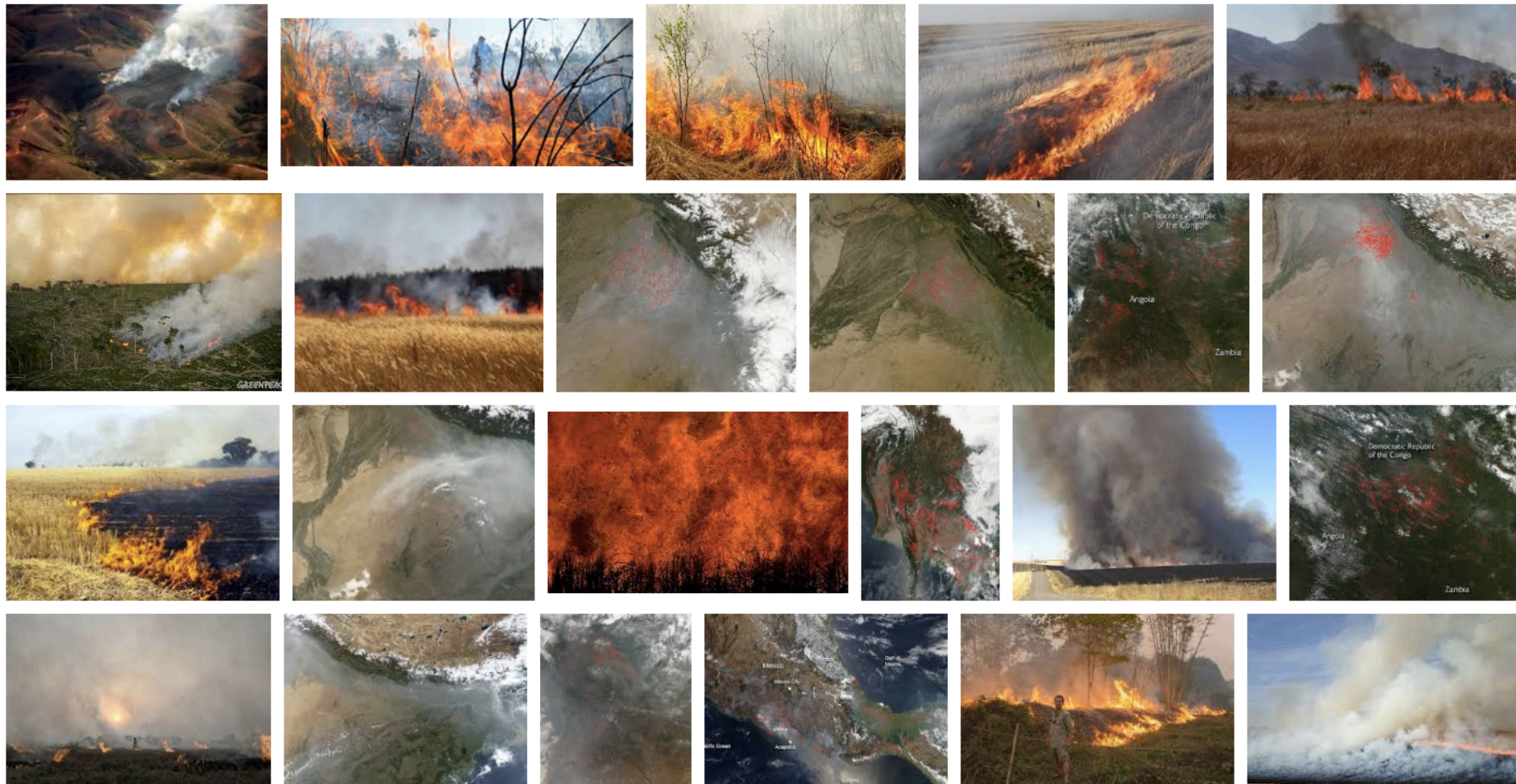
Fires in Pictures – Google Image Search



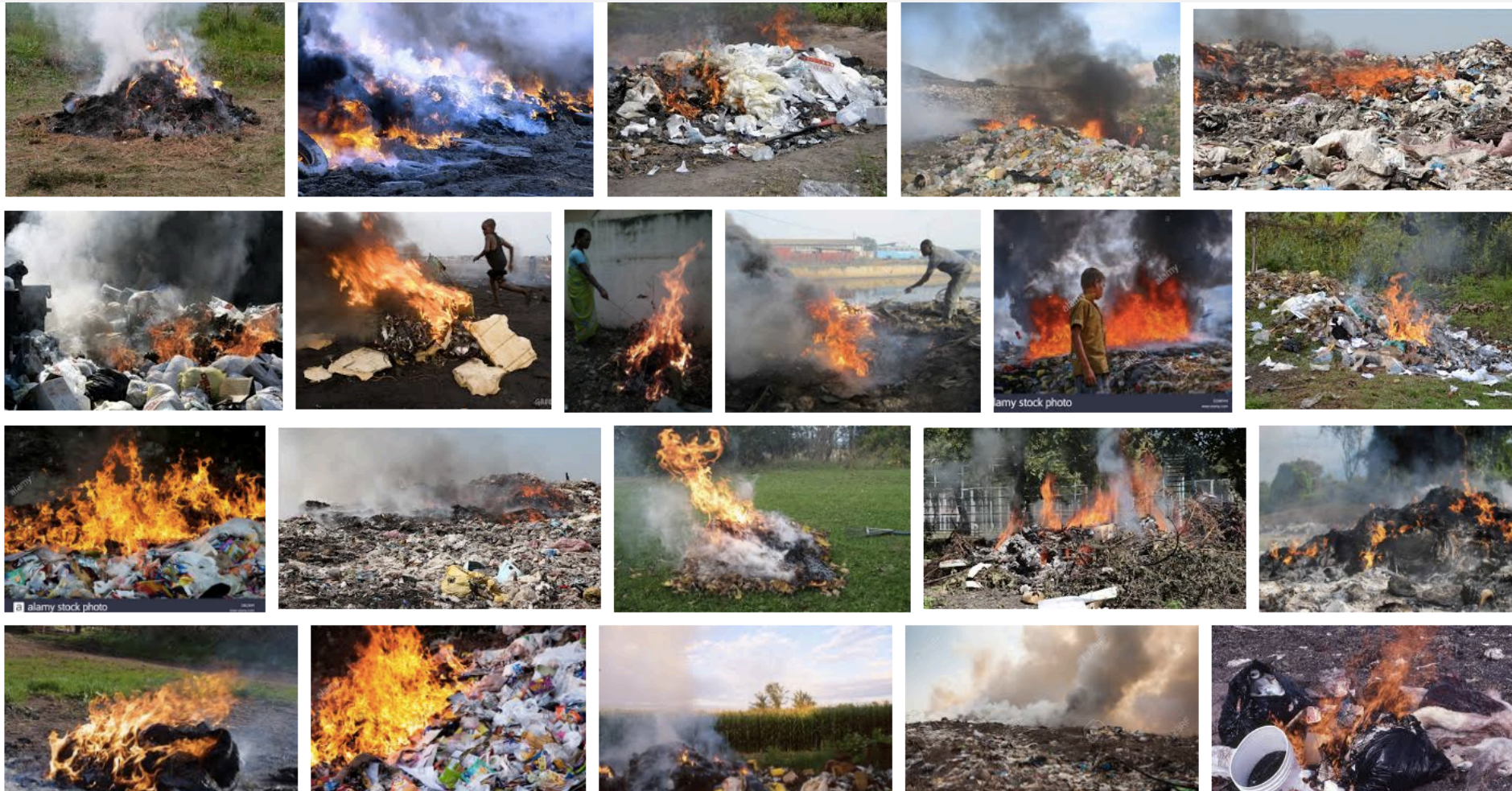
Forest Fires in Pictures - Google Image Search



Agriculture Fires in Pictures - Google Image Search



Waste Burning in Pictures - Google Image Search

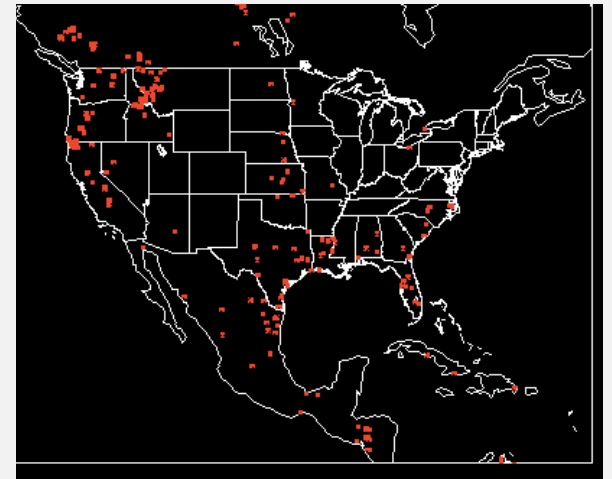
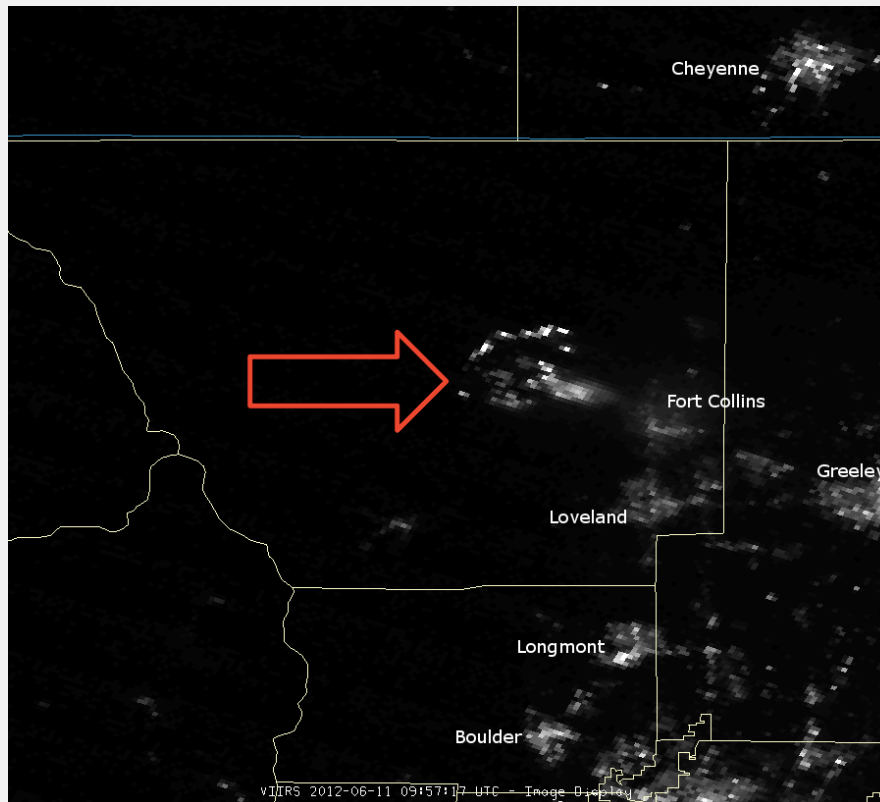


Importance of Smoke and Fire Monitoring

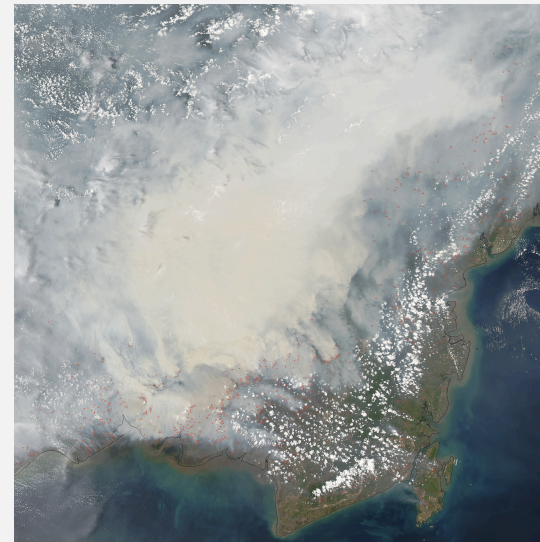
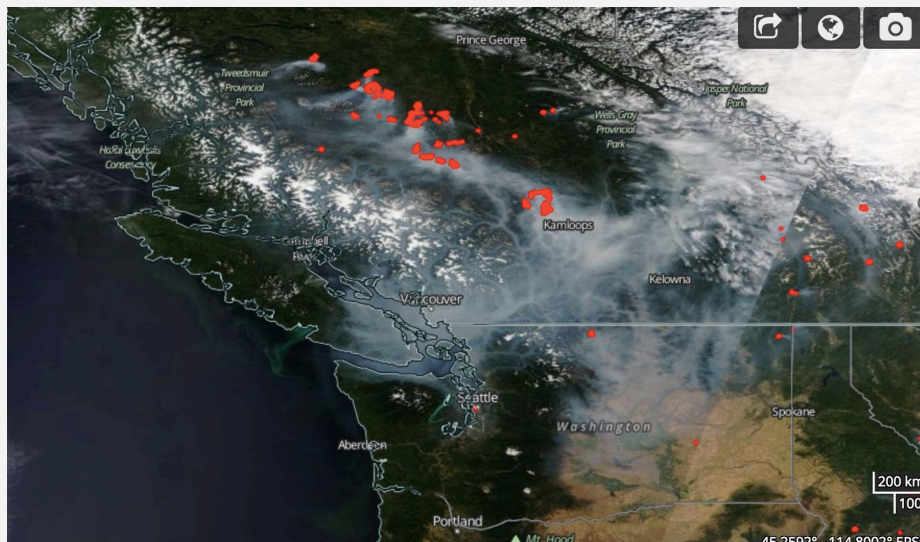
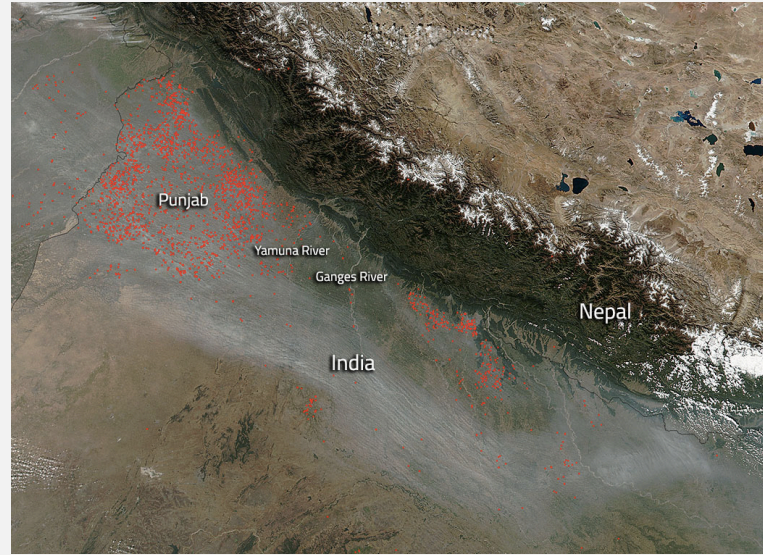


Fire Detection From Satellites

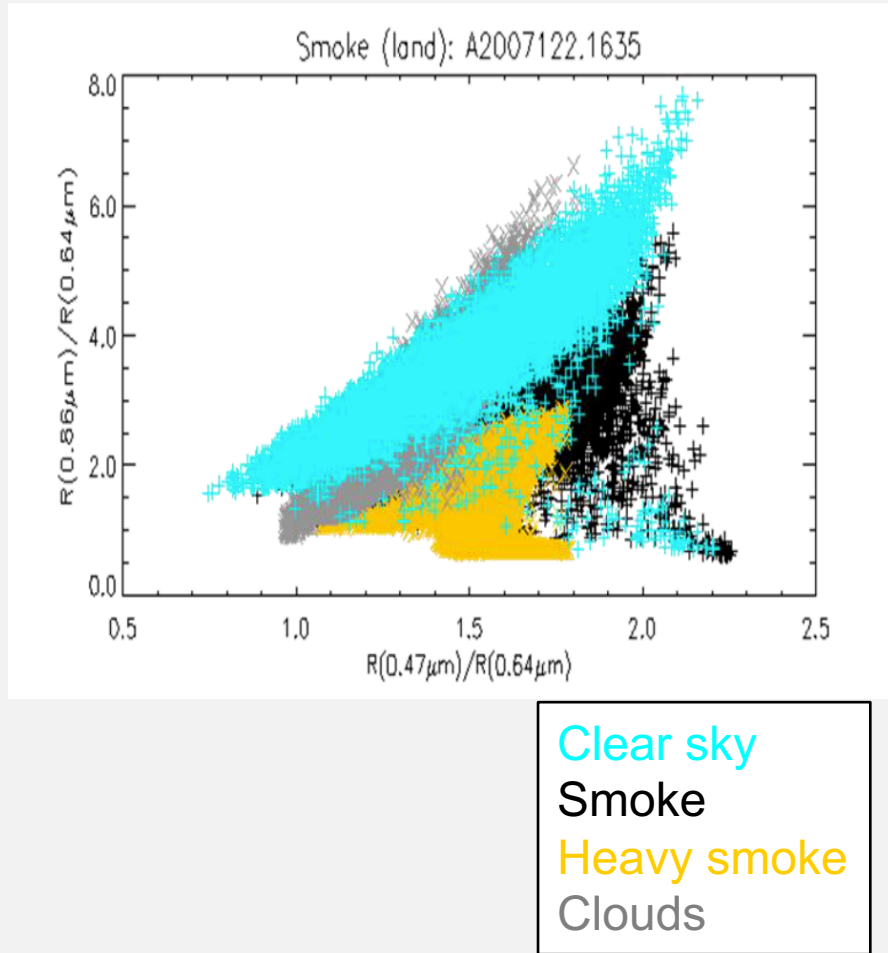
- By detecting smoke
- By detecting temperature anomaly
- By detecting light



Visible Smoke From Fires



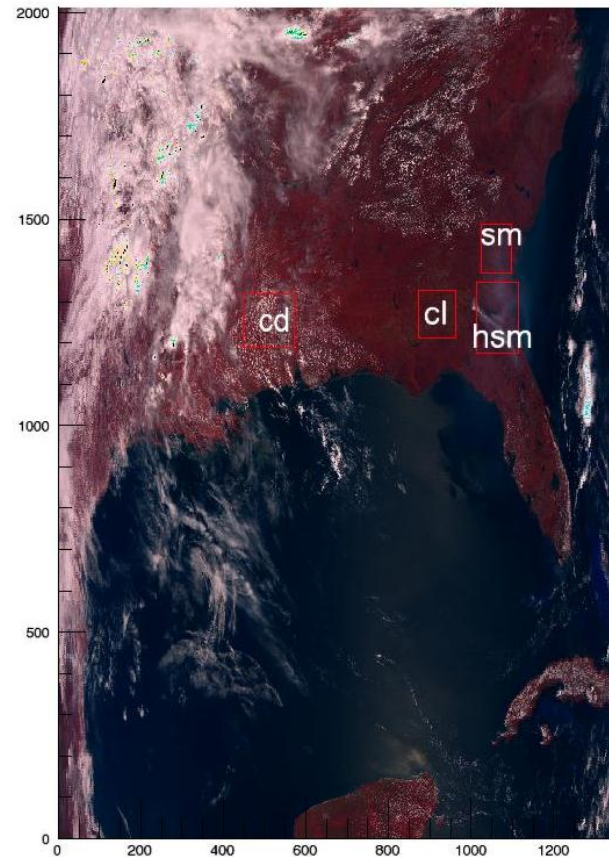
Spectral Signatures - Smoke Over Land



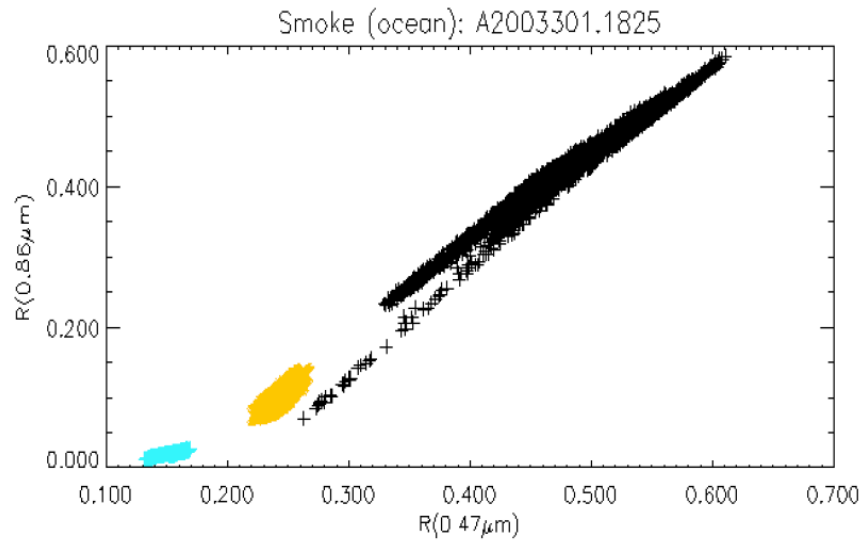
Zhao et al., 2010

Smoke Case (May 2, 2007; 16:35UTC; Terra)

RGB (2007122.1635)

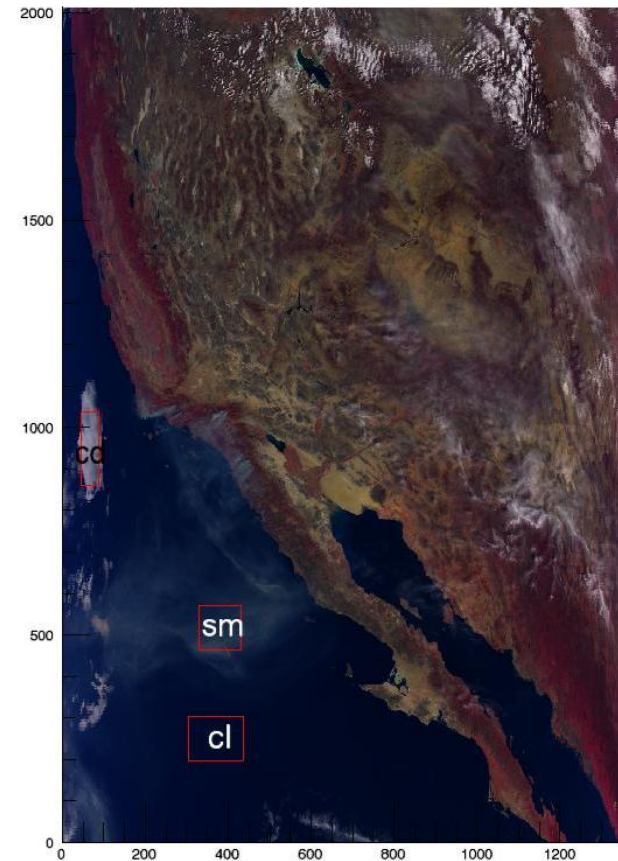


Spectral Signatures - Smoke Over Ocean

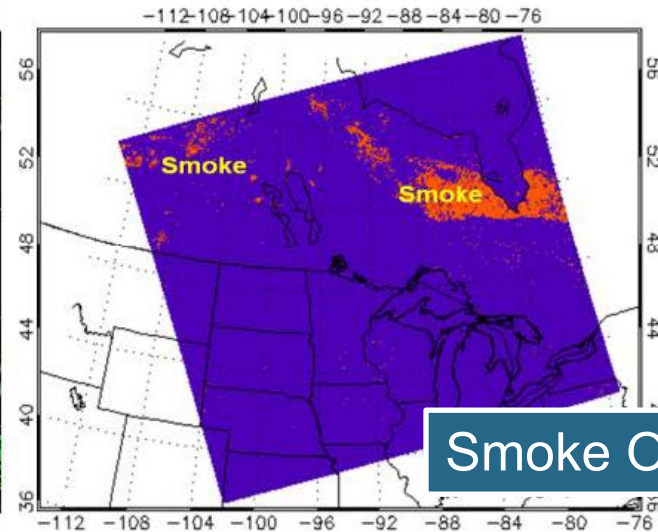


Clear sky
Smoke
Heavy smoke
Clouds

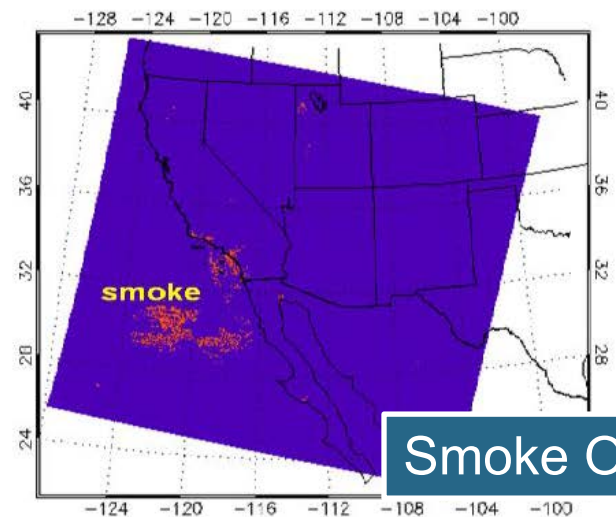
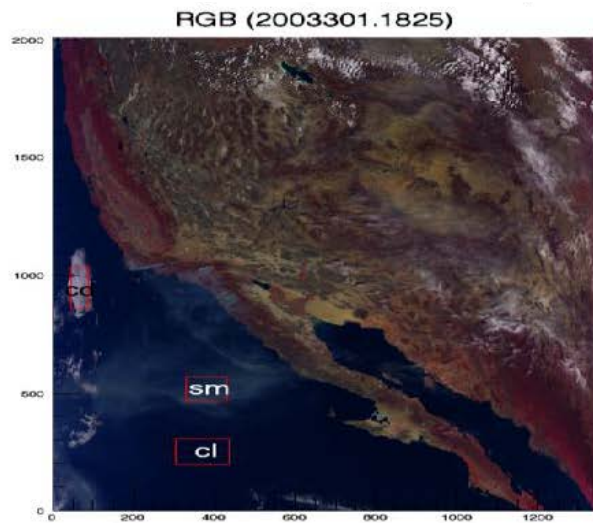
Smoke Case (Oct. 28, 2003; 18:25UTC; Terra)
RGB (2003301.1825)



Smoke Detection Example (Zhao et al., 2010)

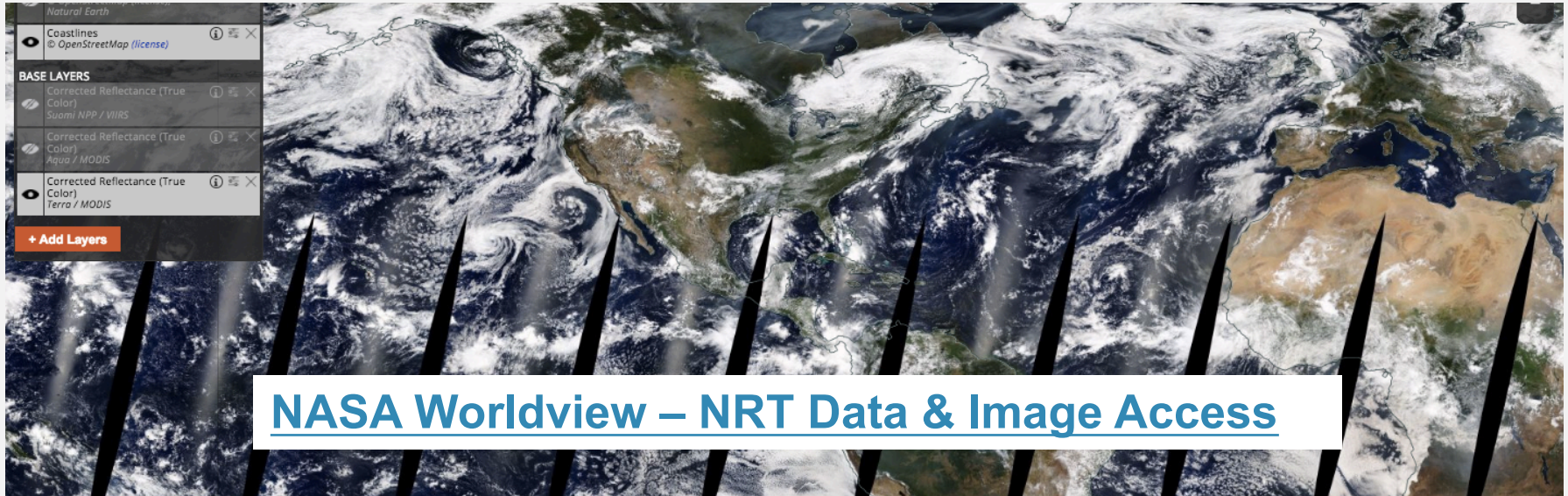


Smoke Over Land



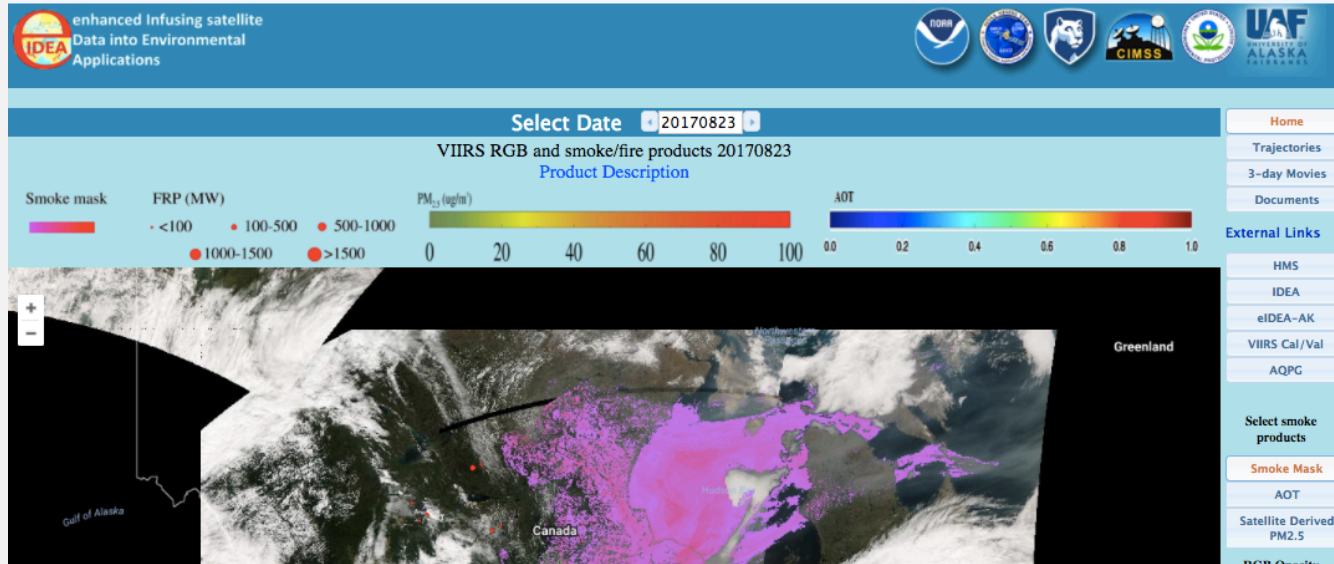
Smoke Over Water

Smoke Monitoring Tools – Worldview



- Visible Imagery (MODIS, VIIRS)
- Fire Detection (MODIS, VIIRS)
- Aerosol Optical Depth (MODIS, OMI, MISR)
- Aerosol Index (OMI)
- Day-Night Band (VIIRS)

Smoke Monitoring Tools – eIDEA



- Visible Imagery (VIIRS, only US & Canada)
- Smoke Mask
- Aerosol Optical Depth
- AirNOW PM2.5
- Satellite derived PM2.5

NOAA's Hazard Mapping System

» OSPO Home » DOC » NOAA » NESDIS » OSPO

NOAA OFFICE OF SATELLITE AND PRODUCT OPERATIONS
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE

ORGANIZATION SERVICES PRODUCTS OPERATIONS

Hazard Mapping System Fire and Smoke Product

Current HMS Analysis


Analysis for day 8/23/2017 last updated at 8/23/2017 21:20:44 GMT



Download GIS files from <ftp://satapsanone.nesdis.noaa.gov/FIRE/HMS/GIS/>

Google KML files: [Fire](#) | [Smoke](#) | [Hysplit](#)

Real-Time Satellite Imagery



[GOES West](#) [GOES East](#) [Active Fire Floater Imagery](#)

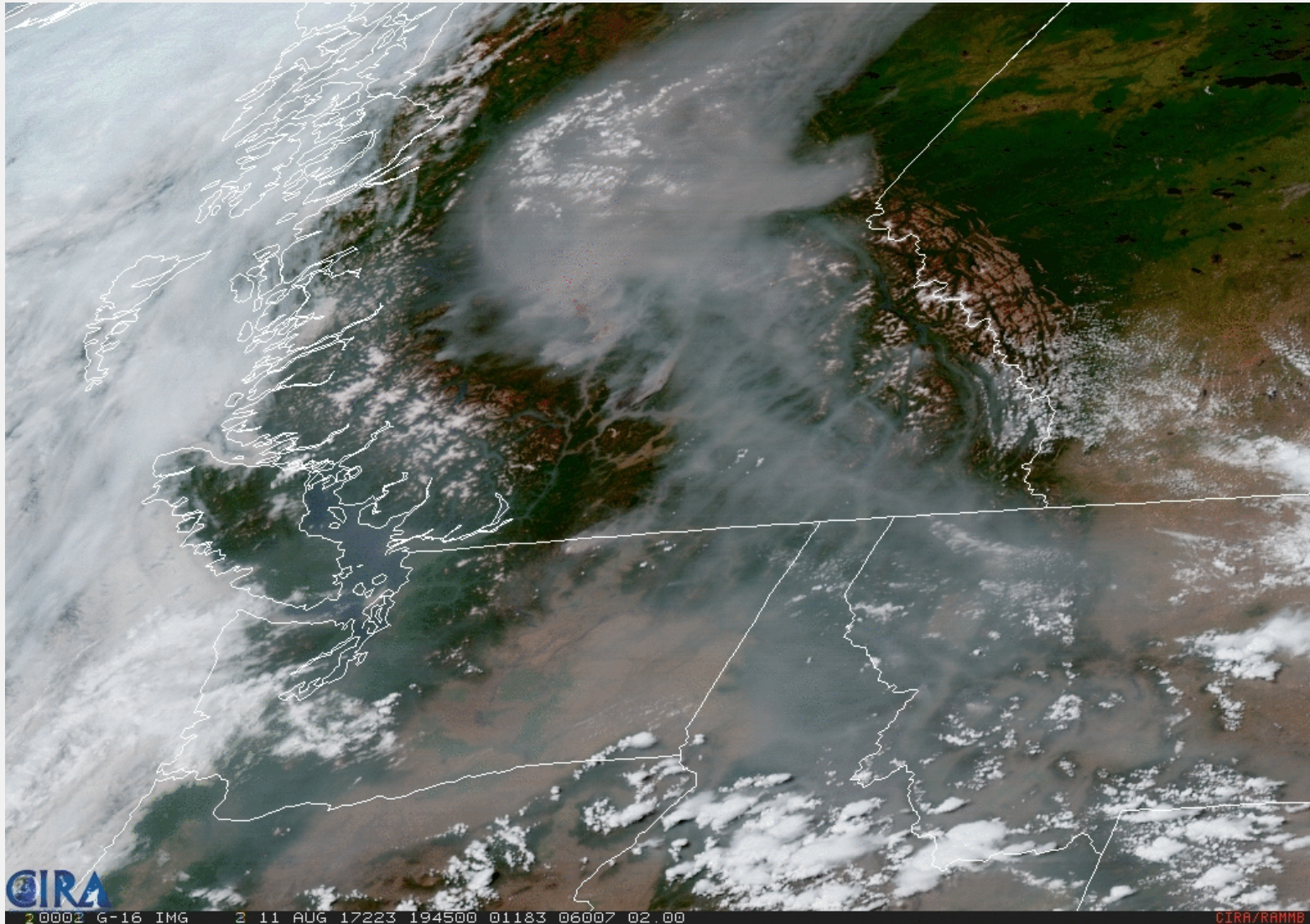
<http://www.ospo.noaa.gov/Products/land/hms.html>

Smoke Monitoring Tools – MISR Plume Height

<https://misr.jpl.nasa.gov/getData/accessData/MisrMinxPlumes2/>

The screenshot displays the MISR Plume Height Project 2 website. At the top, the NASA Jet Propulsion Laboratory logo and name are visible, along with navigation links for JPL HOME, EARTH, SOLAR SYSTEM, STARS & GALAXIES, and SCIENCE & TECHNOLOGY. Below this, the MISR logo and the text 'Multi-angle Imaging SpectroRadiometer' are shown. A search bar and a 'Go' button are present. The left sidebar contains a 'Get Data' section with links to 'Access Data', 'MISR Plume Height Project', 'MISR Plume Height Project 2', 'MISR Data System', 'Product Maturity Levels', and 'Local Mode Data'. The main content area features the heading 'ACCESS DATA' and 'MISR Plume Height Project 2'. It lists the project team: David Nelson, Sebastian Val, Ralph Kahn, Ernest Koeberlein, Mike Tosca, David Diner, and Cecelia Lawshe. A note indicates 'July, 2015 - see what's changed' and 'Access data digitized with earlier versions of MINX'. There are three radio buttons for selecting data types: 'Wildfire smoke plumes' (selected), 'Volcanic plumes', and 'Dust plumes'. A 'Search' button is located below these options. The bottom section is titled 'Fast Search for All Plumes in a Clicked Region' and shows a world map with color-coded regions: North America (green), South America (yellow), Europe (purple), Africa (blue), Asia (red), and Australia (orange).

GOES-R or GOES-16



Other Tools

- NASA's GEOS-5 Aerosol Forecasts

https://portal.nccs.nasa.gov/cgi-fp/fp_2d_chem.cgi

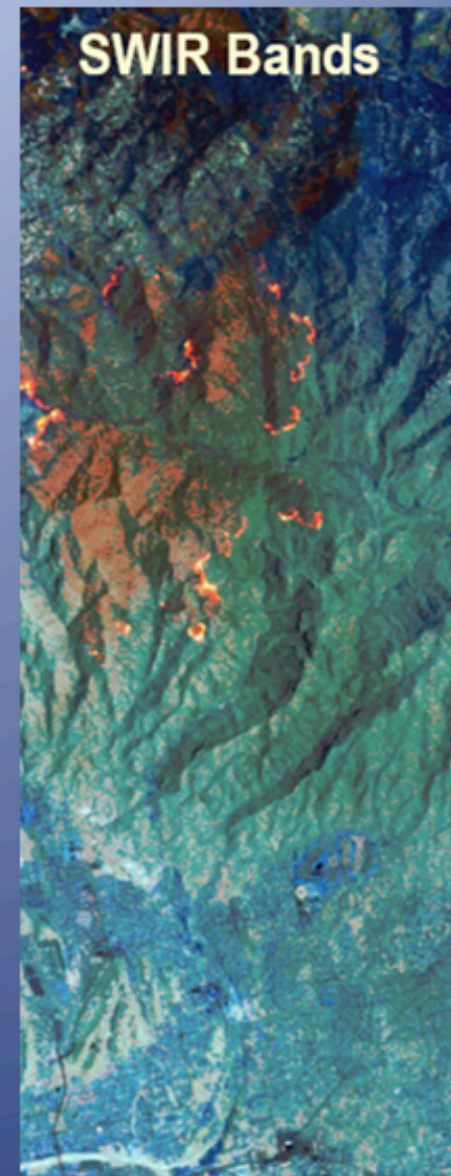
- NRL Forecasts

<https://www.nrlmry.navy.mil/aerosol/#currentaerosolmodeling>



The image is a satellite photograph of a coastal area, likely the Persian Gulf. A semi-transparent grey rectangular box covers the central portion of the image. Within this box, there are several red annotations: small circles and larger, irregular red outlines that appear to highlight specific land features or vessels. The word "Extra" is printed in a black, sans-serif font in the lower-left corner of the grey box, with a horizontal black line extending to the right from its base. The background shows the dark blue of the sea, the lighter tan of the land, and swirling white clouds.

Extra



$$BI = \frac{\rho_{1100} - \rho_{2200}}{\rho_{1100} + \rho_{2200}}$$

The Burn Index (BI) is used to detect burn scars due to wildfires. It has the Advantage over the NDVI in that it uses wavelengths that are transparent to smoke (1.1 and 2.2 microns).

Change is Reflectance After Fire

